am convinced that lava dust it was, but can get no one to coincide with my opinion.' Can this be a relation to the Norway dust? I see your Norway note says the wind blew strongly from north-north-west, which would bear towards the Red Sea."

M. NAPOLI, electrician to the French Great Eastern Railway, has published in the *Aëronaut* an article showing that electricity supplies a less ponderous motive power than steam for propelling balloons. He supposes that 3230 grammes of material is enough to generate, by means of Bunsen elements, an electric current able to give with a Gramme machine of a convenient construction one horse-power working during an hour.

ON the evening of February 28, at 8·40 p.m., two travellers sledging over the Lesjö, a remote lake in Värmland, in Sweden, saw a meteor of remarkable size and lustre fall about a mile off. Their backs were turned at the time of its appearance, but its luminosity was so strong that the whole country round was illuminated, and when they turned its brilliancy blinded them for a few seconds. Its track was marked by a vivid band, to the eye one foot broad and three yards long, of a yellowish colour. The meteor, after about five seconds, burst with a shower of sparks of the same colour before striking the earth. The night was perfectly clear.

THE Swedish Chamber of Agriculture has granted a Mr. A. Carlsson 50*l.* for the practical study of English agriculture during the coming season.

IT is undoubted that Gramme was the first to construct a dynamo-electric machine with continuous induction, using (independently of Pacinotti) a ring-armature similar to Pacinotti's ring. But regarding the question, who it was that first produced continuous dynamo electric currents, and so was the first to combine experimentally the principles of Siemens and Pacinotti, Prof. von Waltenhofen offers proof (*Wied. Ann.* No. 2) that this priority belongs to Prof. Pfaundler of Innsbruck. In 1867 Herr Kravogl of Innsbruck showed his electromagnetic motor at the Paris Exhibition; this consists of coils forming a hollow ring which rotates round a horizontal axis, while it incloses a bent cylindrical rod tending by weight to take the lowest position, but kept suspended in a certain raised position by currents in the coils, whereby also the ring is rotated. In a letter on this machine in 1867 Prof. Pfaundler proposed to apply Siemens's principle to it, and get electric currents from mechanical work of rotation (the battery being included at first with a shunt, then quite excluded). This he tried and effected about three years later, as a letter dated February 11, 1870, records. Thus Pfaundler seems to have produced continuous dynamo-electric currents before Gramme, and to have indicated the possibility of getting such currents from the Kravogl ring machine in the same year (1867) as Siemens's invention of dynamo-electric machines acquired publicity.

THE Committee of the Annonay Montgolfier celebration have already collected 60,000 francs, and subscriptions are pouring in. They have decided upon the publication of a special organ, of which the first number will be issued in a few days. The celebration will consist in the erection of a statue to the two brothers, several ascents, the sending up of a Montgolfier similar to the original one, and a cavalcade representing the provincial officials, who witnessed the proceedings on June 5, 1783.

IT seems to result from recent researches by A. W. Pehl, brought before the Russian Chemical Society, that the poisonous action of the ergot, the bad effects of which are so often witnessed in Russia, is due to putrefaction poisons called ptomaines, which appear during the decomposition of the albuminoids in flour. The ergot, that is the sclerotium of the small mushroom, *Claviceps purpurea*, has energetic peptic qualities and thus would directly contribute to the formation of ptomaines in the flour.

WE have received the last number of the Caucasian *Izvestia*, which appeared at Tiflis on February 24. It contains several interesting papers; M. Stebnitzky contributes a paper on the measurements by Parrot, in 1829, of the seconds pendulum on the Great Ararat, and, introducing all necessary corrections for rendering them comparable with recent measurements, he arrives at the result that the length of the pendulum at the monastery of St. Jacob on the Ararat is 440·1613 Paris lines. The anomaly would be thus equal to 7·7 swings per day, and corresponds to an elevation of geoide on the normal spheroid of 855 metres. Compared with Tiflis (1343 metres), this diminution of gravity would point out the existence of great cavities in the Ararat. We notice also a paper on the changes of height of the level of the Caspian Sea, by M. Filipoff; measurements of heights in the villayet of Trapezunt; complementary notes to the formerly-published anthropological measurements, by M. Erxert; and a summary of the first part of M. V. Miller's researches on the Osetian language. In the bibliographical part we find an interesting sketch of the climate of the Caucasus, on the ground of the meteorological observations published by Dr. H. Wild in his work, "Die Temperatur-Verhältnisse des Russichen Reichs," and a report, by M. Zagursky, on Baron Uslar's posthumous work on the Tabasatan language; it is a serious work, containing a very elaborate grammar of the language, a list of words, and a chestomathy. The same fascicule contains the necrologies of Dr. Land and Count Sollogoub, and a variety of notes. In the appendix we find a translation of Mr. Palgrave's reports on Anatolia and Lazistan, which are considered as the more reliable with regard to population.

A SERIES of shocks, lasting several seconds, believed at present to be due to earthquake, were felt at Amsterdam at 5 a.m. on March 17. The movement was in a vertical direction, and caused mirrors and other pendent articles of furniture to oscillate.

THE additions to the Zoological Society's Gardens during the past week include a Common Wigeon (*Mareca penelope* ♂), British, presented by Lieut.-Col. C. Birch Reynordson; three Sirens (*Siren lacertina*) from South Carolina, presented by Mr. G. E. Manigault; six Common Squirrels (*Sciurus vulgaris*), British, a Lemur (*Lemur* ——) from Madagascar, two Robben Island Snakes (*Coronella phocarum*) from Robben Island, South Africa, purchased; a Gayal (*Bibos frontalis*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

THE COMET 1883 *a*.—From elements calculated by Dr. Hepperger of Vienna upon observations extending from Feb. 24 to March 4, the following ephemeris for midnight at Berlin results:—

	R.A. h. m. s.	Decl. ° ′	Distance from Earth.	Sun.
March 30	3 29 24	+21 49·2	1·497	1·073
31	3 33 59	21 19·5		
April 1	3 38 25	20 50·3	1·536	1·098
2	3 42 44	20 21·4		
3	3 46 55	19 52·9	1·576	1·124
4	3 50 58	19 24·8		
5	3 54 55	18 57·0	1·616	1·150
6	3 58 46	18 29·6		
7	4 2 32	18 2·7	1·657	1·177
8	4 6 13	17 36·2		
9	4 9 48	+17 10·2	1·698	1·204

The ascending node of this comet falls at a radius-vector of about 2·36 in the region of the minor planets, the descending node at a radius-vector of 1·12, or 0·14 outside the earth's path; but, for the comet to pass at its least distance from our globe, the perihelion passage must occur about November 16.

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THE MINOR PLANET No. 228.—The nearest approach to the earth's orbit made by any one of the 232 small planets so far known appears to occur in the case of No. 228, discovered by Herr Palisa at Vienna on August 19, 1882. At the perihelion point this planet may be distant from us only 0·662 of our mean distance from the sun, and on this account would prove a favourable object for a determination of solar parallax. But unfortunately the brightness of the planet at discovery was only 12·5m., though the mean anomaly was then 1½°, or the perihelion passage took place five days subsequently. Hence it is very questionable if such an object could be utilised for the purpose. No. 132, *Æthra*, has the smallest perihelion distance (1·6038), but in consequence of the large angle between the lines of nodes and apsides, and an inclination of nearly 25°, this planet is much further from the earth's track at perihelion than No. 228. *Andromache*, No. 175, recedes furthest from the sun, the distance at aphelion being 4·7234, or within 0·48 of the mean distance of Jupiter.

BINARY STARS.—According to Dr. Doberck's orbit of γ Coronæ Borealis, this very difficult object should now be measurable with our larger instruments. For 1883·5 the calculated position is 123°, and the distance 0″·34. This object was single, with the great refractor at Washington, from 1875 to 1879. In June, 1881, it was pronounced round, or doubtfully elongated, by Mr. Burnham, who remarks, "It has been apparently single with all apertures since about 1871." Doberck's period of revolution is 95½ years: periastron passage, 1843·7.

The following calculated angles and distances of several other binaries may serve for comparison with observations :—

Epoch.	Star.	Position.	Distance.	Authority for orbit.
1882·5	η Cassiopeiæ	163°·3	5″·52	Doberck.
	,,	161·8	5·38	Duner.
1882·5	ξ Böotis	268·9	3·56	Doberck.
1883·5	,,	267·6	3·20	,,
1882·5	ω Leonis	86·5	0·60	,,
1883·5	,,	88·2	0·61	,,
1882·5	η Coronæ Bor.	140·9	0·51	,,
1882·5	ζ Herculis	105·9	1·43	,,
1882·5	μ^2 Herculis	297·3	0·88	,,
1882·5	70 Ophiuchi	63·5	2·98	Tisserand.

ELECTRICAL TRANSMISSION OF FORCE AND STORAGE OF POWER[1]

DR. SIEMENS, in opening the discourse, reverted to the object the Council had in view in organising these occasional lectures, which were not to be lectures upon general topics, but the outcome of such special study and practical experience as Members of the Institution had exceptional opportunities of acquiring in the course of their professional occupation. The subject to be dealt with during the present session was that of electricity. Already telegraphy had been brought forward by Mr. W. H. Preece, and telephonic communication by Sir Frederick Bramwell.

Thus far electricity had been introduced as the swift and subtle agency by which signals were produced either by mechanical means or by the human voice, and flashed almost instantaneously to distances which were limited, with regard to the former, by restrictions imposed by the globe. To Dr. Siemens had been assigned the task of introducing to their notice electric energy in a different aspect. Although still giving evidence of swiftness and precision, the effects he should dwell upon were no longer such as could be perceived only through the most delicate instruments human ingenuity could contrive, but were capable of rivalling the steam engine, compressed air, and the hydraulic accumulator, in the accomplishment of actual work.

In the early attempts at magneto-electric machines, it was shown that, so long as their effect depended upon the oxidation of zinc in a battery, no commercially useful results could have been anticipitated. The thermo-battery, the discovery of Seebeck in 1822, was alluded to as a means of converting heat into electric energy in the most direct manner; but this conversion could not be an entire one, because the second law of thermodynamics, which prevented the realisation as mechanical force of more than one-seventh part of the heat energy produced in combustion under the boiler, applied equally to the thermo-electric battery, in which the heat, conducted from the hot points of juncture to the cold, constituted a formidable loss. The electromotive force of each thermo-electric element did not exceed 0·036 of a volt, and 1800 elements were therefore necessary to work an incandescence-lamp.

A most useful application of the thermoelectric battery for measuring radiant heat, the thermopile, was exhibited. By means of an ingenious modification of the electrical pyrometer, named the Bolometer, valuable researches in measuring solar radiations had been made by Prof. Langley.

Faraday's great discovery of magneto-induction was next noticed, and the original instrument by which he had elicited the first electric spark before the members of the Royal Institution in 1831, was shown in operation. It was proved that although the individual current produced by magneto-induction was exceedingly small and momentary in action, it was capable of unlimited multiplication by mechanical arrangements of a simple kind, and that by such multiplication, the powerful effects of the dynamo-machine of the present day were built up. One of the means for accomplishing such multiplication was the Siemens armature of 1856. Another step of importance was that involved in the Pacinnoti ring, known in its practical application as the machine of Gramme. A third step, that of the self-exciting principle, was first communicated by Dr. Werner Siemens to the Berlin Academy, on January 17, 1867, and by the lecturer to the Royal Society on the 4th of the following month. This was read on February 14, when the late Sir Charles Wheatstone also brought forward a paper embodying the same principle. The lecturer's machine which was then exhibited, and which might be looked upon as the first of its kind, was shown in operation; it had done useful work for many years as a means of exciting steel magnets. A suggestion, contained in Sir Charles Wheatstone's paper, that "a very remarkable increase of all the effects, accompanied by a diminution in the resistance of the machine, is observed when a cross wire is placed so as to divert a great portion of the current from the electro-magnet," had led the lecturer to an investigation read before the Royal Society on March 4, 1880, in which it was shown that by augmenting the resistance upon the electro-magnets a hundredfold, valuable effects could be realised, as illustrated graphically by means of a diagram. The most important of these results consisted in this, that the electromotive force produced in a "shunt-wound machine," as it was called, increased with the external resistance, whereby the great fluctuations formerly inseparable from electric-arc lighting could be obviated, and that, by the double means of exciting the electro-magnets, still greater uniformity of current was attainable.

The conditions upon which the working of a well-conceived dynamo-machine must depend were next alluded to, and it was demonstrated that when losses by unnecessary wire-resistance, by Foucault-currents, and by induced currents in the rotating armature were avoided, as much as 90 per cent., or even more, of the power communicated to the machine were realised in the form of electric energy, and that *vice versâ* the reconversion of electric into mechanical energy could be accomplished with similarly small loss. Thus, by means of two machines at a moderate distance apart, nearly 80 per cent. of the power imparted to the one machine could be again yielded in the mechanical form by the second, leaving out of consideration frictional losses, which latter need not be great, considering that a dynamo-machine had only one moving part well balanced, and was acted upon along its entire circumference by propelling force. Jacobi had proved many years ago that the maximum efficiency of a magneto-electric engine was obtained when

$$\frac{e}{E} = \frac{w}{W} = \tfrac{1}{2}$$

which law had been frequently construed by Verdet ("Théorie Mécanique de la Chaleur") and others to mean that one-half was the maximum theoretical efficiency obtainable in electric transmission of power, and that one-half of the current must be necessarily wasted or turned into heat. The lecturer could never be reconciled to a law necessitating such a waste of energy, and had maintained, without disputing the accuracy of Jacobi's law, that it had reference really to the condition of maximum work accomplished with a given machine, whereas its efficiency must be governed by the equation

$$\frac{e}{E} = \frac{w}{W} = \text{nearly } 1.$$

From this it followed that the maximum yield was obtained

[1] Abstract of lecture given at the Institution of Civil Engineers on March 15 by Dr. C. William Siemens, F.R.S., M.Inst.C.E. Revised by the author.

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